

Appendix G

SMOKE OPERATIONS

CONTENTS		Page
SECTION I.	Smoke Terminology and Planning Considerations	G-1
	Categories of Smoke Operations	G-1
	Battlefield Applications of Smoke	G-1
	Smoke Delivery Systems	G-2
	Smoke Planning Considerations	G-3
SECTION II.	Tactics	G-6
	Offense	G-6
	Defense	G-7

SECTION I. SMOKE TERMINOLOGY AND PLANNING CONSIDERATIONS**Categories of Smoke Operations**

There are two categories of smoke operations hasty and deliberate.

Hasty Smoke Operations

Hasty smoke operations are conducted with minimal planning. They can be used to support a combined arms force to counter an enemy action or anticipated enemy action of immediate concern the commander. Hasty smoke is usually executed by the projected, on-board, or smoke generator units available at the time of the engagement. Hasty smoke can be planned as on-call smoke in smoke plans, and it usually covers a small area for a short duration.

Deliberate Smoke Operations

Deliberate smoke operations are conducted with detailed planning, usually by brigades, divisions, or corps. They are normally synchronized with specific times, events, or locations on the battlefield. Deliberate smoke operations normally include multiple preplanned smoke operations and cover large areas for long periods of time.

Battlefield Applications of Smoke

Smoke has four battlefield applications that support combat operations: obscuring, screening, deceiving and marking.

Obscuring Smoke

Obscuring smoke is delivered directly onto and immediately in front of enemy positions to blind or degrade their vision both within and beyond their location. Projected means, such as artillery, mortars, rockets, and rifle grenades, generally deliver obscuring smoke.

Screening Smoke

Screening smoke is delivered in areas between friendly and enemy forces or in friendly operational areas to degrade enemy ground or aerial observation. Screening smoke delivery sources consists of generators, smoke pots, and air delivery systems. Screening smoke can be used to conceal ground maneuver, breaching operations, and key assembly areas and supply routes. There are three visibility categories for screening smoke: smoke haze, smoke blanket, and smoke curtain.

Smoke Haze

A smoke haze is a light concentration of screening smoke used to restrict accurate enemy observation and fire without disrupting friendly operations within the screen. A smoke haze is defined as a concentration of smoke that would allow an individual to identify a small tactical vehicle between 50 and 150 meters away, but no farther than 150 meters.

Smoke Blanket

A smoke blanket is a dense concentration of screening smoke that provides maximum concealment of friendly areas from enemy ground and aerial observation. A smoke blanket may hamper operations of friendly troops by restricting movement and activity within the screen. A smoke blanket is defined as a concentration of smoke that would allow the identification of a small tactical vehicle up to 50 meters away, but no farther.

Smoke Curtain

A smoke curtain is a dense vertical development of smoke placed between friendly and enemy positions to prevent or degrade enemy ground observation of friendly positions. Smoke curtains should be used when friendly forces have air superiority or air parity. A smoke curtain will not prevent enemy aerial observation, but may force enemy aircraft to fly higher to see behind the curtain, making them more vulnerable to air defense weapons.

Deception Smoke

Deception smoke is used to confuse or mislead the enemy. Generally, it is used in conjunction with other deception measures. Deception smoke, such as from vehicle-mounted smoke grenade launchers and vehicle engine exhaust smoke systems (VEESS), can be used to provide protection to friendly equipment and troops. The smoke screens vehicle movements, defeats enemy guidance systems, and provides concealed firing positions.

Marking Smoke

Marking smoke is used to mark targets, identify friendly positions, and provide for prearranged battlefield communications. Projected smoke and hand smoke grenades are usually used for marking smoke.

Smoke Delivery Systems

Effective smoke delivery is achieved by integrating the three means of producing smoke: projected, self-defense and generated smoke devices. Successful smoke operations are achieved by the integration and synchronization of all these sources with other battlefield systems.

Projected Smoke

Projected smoke is produced by artillery or mortar munitions, naval gunfire rockets, bombs, and generator smoke from fixed-wing aircraft. The advantage of using projected smoke is that you can place smoke directly on a deep, close, or rear target. Most projected smoke devices and munitions are lethal and cannot be used on or near friendly forces. Projected smoke can support both short- and long-duration missions, but most basic loads for munitions are insufficient for sustaining smoke on target. Therefore, advanced logistical planning may be required. The ideal battlefield applications for projected smoke are producing obscuring smoke, initiating screening smoke, and marking targets.

Self-Defense Smoke

Self-defense smoke is produced primarily by smoke grenade launchers and VEESS. These systems provide rapid smoke production, responsiveness and enhanced survivability to the small unit leader. The vehicle grenade launchers are primarily for individual vehicle use. Once fired, they must be reloaded from outside the vehicle. Vehicle grenade launchers may be of danger to dismounted troops. The VEESS may be used not only for self-defense of individual vehicles, but to provide screening smoke for small units. The system is designed with flexibility in mind to meet the needs of a fluent battlefield. It produces smoke to cover vehicle movement and degrades the enemy's ability to acquire and engage targets. The VEESS is most effective when used as a self-protective mechanism to cover the movement of a combat vehicle from one battle position to another. The VEESS used under any other condition would be a secondary method of employment. The risk factor increases substantially when used to screen unit formations. The consideration to use VEESS must be based on the tactical situation and METT-T. The vehicle may be silhouetted against the smoke if the VEESS or the smoke grenade launcher is used incorrectly. If properly used, VEESS is an effective combat multiplier. The VEESS consumes approximately 1 gallon of fuel per minute of operation. It can only be operated when the engine is running. Both vehicle smoke grenade launchers and VEESS can pinpoint vehicle locations and interrupt target acquisition during evasive maneuvers.

Generated Smoke

Generated smoke is produced by smoke pots, smoke grenades, and air or ground smoke generators. Generated smoke is delivered to the target area by steering winds. Generated smoke can be combined with projected smoke to provide depth of coverage throughout the battlefield. Generated smoke can cover small and large areas for an indefinite period of time based on the availability of logistical support, particularly fuel. Smoke pots and smoke grenades can be pre-positioned and ignited manually or electrically. Smoke generator units produce large volumes of smoke to support hasty or deliberate smoke operations.

Smoke Planning Considerations

To be effective, smoke must be used in sufficient quantities. Factors affecting the quantity are atmospheric conditions, type of smoke required, size of the area to be smoked, and length of time smoke is needed.

Electro-optical Systems Defeated by Smoke

Planning for the use of smoke must begin with an understanding of the electro-optical systems that the various types of smoke will defeat. Figure G-1 is a tactical decision aid for selecting the type of smoke to defeat a particular electro-optical system. By combining intelligence estimates of enemy electro-optical capabilities, knowledge of friendly electro-optical systems and available smoke delivery means, tactical planners can make sound decisions regarding use of smoke on the battlefield.

Weather Effects

In planning, local expected weather conditions and weather forecasts are used to plan tactical operations. Actual weather conditions at the time of execution may vary; plans need to allow for this.

Winds

Wind direction determines where the smoke must be released and where it will travel.

Wind speed also influences smoke behavior. Low wind speeds or calm winds will allow smoke to remain in the target area for a longer period of time. Some types of smoke behave differently in different wind conditions. For example, white phosphorus smoke tends to pillar if winds are less than 9 knots (17 kmph). HC smoke rises when the wind speed is less than 4 knots (7 kmph), and is torn apart by winds over 13 knots (24 kmph). Smoke from mechanical generators may be effective in higher wind speeds because of greater volume, but may not disperse adequately in low-wind speeds or calm conditions.

Winds may not always be favorable for smoke employment and smoke plans should contain contingencies for unfavorable wind conditions. Tactical planners should plan smoke according to desired effect and target

Spectral Region	Electro-Optical System	Type of Smoke
Visible 0.40–0.75 mm	Viewers: – Daylight Sights – Naked Eye – Camera Lens – Binoculars/Standard Optics – Battlefield TV – CLOS Missiles (for example AT-3) – Night Sights	All
Near IR 0.75–4.00 mm	Viewers: – SACLOS Missiles (for example, AT-4 and AT-5) – Night Sights	All
	Sensors: – Laser Designators – Laser Range finders	All
Mid-IR 4–14 mm	Viewers: – Passive Thermal Sights	WP, PWP, RP, Type III IR Obscurant, Dust
Far-IR 14–100 mm	Sensors: – Thermal Imagers – Terminal Homing Missiles (AT-6)	WP, PWP, RP, Type III IR Obscurant, Dust
MM Wave and Lower Frequency 1.10 mm	Radar Radio Microwaves	WP and PWP (Instantaneous Interruption Only), Developmental Obscurants
X Ray and Higher Frequency	Directed EMP Nuclear Weapons	Oil Smoke (Attenuation Only), Developmental Obscurants

Figure G-1. Electro-optical systems defeated by smoke.

area. Actual release point for smoke may have to be varied to achieve the desired effect. For example, giving an exact location from which a smoke unit is to produce smoke may not allow the unit to achieve desired coverage of a target. Tactical planners should identify the desired coverage and maintain flexibility within the plan to allow the unit to select a location from which they can produce the smoke, given the wind conditions at the time. In some tactical situations, it may be necessary to cancel a smoke mission due to unfavorable winds.

Temperature Gradients

Temperature alone does not affect smoke, except as it relates to temperature gradients. Temperature gradients are determined by comparing the air temperature at .5 meter above the ground with the air temperature at

4 meters. Three types of temperature gradients influence smoke unstable (lapse), neutral, and stable (inversion). Figure G-2 depicts temperature gradients and smoke behavior.



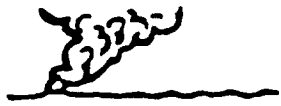
Time of Day and Weather Conditions	Temperature Gradient	Smoke Behavior (Wind Direction—)
Night— until 1 hr after sunrise. Wind speed is less than 9 kmph (5 knots). Cloud cover less than 30%.	Stable (Inversion) (Ideal)	
Day—most often between 1 to 2 hr before and after sunrise. Wind speed is 9 kmph (5 knots) or more. Cloud cover is 30% or more.	Neutral (Favorable)	
Day— beginning 2 hr after sunrise. Wind speed is less than 9 kmph (5 knots). Cloud cover is less than 30%.	Unstable (Lapse) (Marginal)	

Figure G-2. Temperature gradient effects on smoke.

Unstable conditions exist when air temperature decreases with an increase in altitude, causing vertical air currents and turbulence. Smoke tends to rise, breaking up and becoming diffused. Unstable conditions are best for producing smoke curtains.

Neutral conditions exist when there is little or no change with an increase in altitude, or when wind speeds are less than 9 kilometers per hour. Vertical movement of air is limited during neutral conditions. Neutral conditions are favorable for producing smoke blankets and smoke hazes.

Stable conditions exist when there is an increase in air temperature as altitude increases, greatly limiting vertical air movement and allowing smoke clouds to remain low to the ground. This is the most favorable temperature gradient for smoke, providing that there is enough wind to carry the smoke over the target area.

Humidity

Smoke particles absorb moisture for the air, increasing the particle size and making the smoke more effective. Most smoke munitions produce denser smoke in higher humidity.

Precipitation

Smoke will give concealment during light rains. Heavy rains and snow will reduce visibility, so smoke is rarely needed for concealment during those conditions.

Cloud cover

Cloud cover can be used as a predictor of smoke behavior. Generally, when the sky is covered with clouds, conditions are stable and favorable for smoke.

Terrain Effects

Since smoke is carried by the wind, it usually follows the contours of the earth. The type of terrain over which the smoke is employed has a great impact on how the smoke behaves.

Flat, unbroken terrain, and water cause the smoke to take longer to blend into a uniform smoke haze or blanket, requiring a greater distance between the smoke release point and the target area.

Obstructions, such as trees and small buildings, tends to make smoke into a uniform screen much closer to the target area.

Large hill masses and mountains tend to split winds and cause strong cross currents which excessively disperse smoke, creating holes in smoke coverage and unevenness in the smoke screen. Thermally induced slope winds make it difficult to establish and maintain a smoke screen.

Slopes and valleys also create thermally-induced slope winds. Winds tend to blow upslope during the day and downslope at night.

SECTION II. TACTICS

Offense

Smoke and obscurants multiply the commander's ability to project combat power at the critical time and place to defeat the enemy. Smoke and obscurants will support any type of offensive operation at any level because smoke generally favors the attacker. Smoke is used to conceal units and individual weapon systems. This enables the commander to maneuver behind a screen and deceive the enemy about his strength and weakness. Smoke can be used to support maneuver, provide additional firepower and protect the force. When used to support maneuver during a hostile assault or during in-stride breaching operations, the tank commander, upon receiving fire halts his tank and issues fire commands to fire the grenade launchers and activate VEESS. The TC immediately backs up under the cover of his smoke screen. The GPS is oriented on the tank's primary sector of fire using daylight optics. The TC directs his crew to move forward slowly until the optics clear the smoke screen. When the crew acquires a target, the TC issues a fire command using the standard precision gunnery techniques for GPS engagement. Do not leave the tank exposed for more than 8 to 10 seconds if a target is not acquired back into the smoke, then quickly move to an alternate firing position. Repeat this process as necessary to defeat the defender or to move from one hull-down position to another along the axis of advance. The VEESS may be used to supplement the immediate smoke provided by the grenade launcher if the wind conditions favor the attacker. Smoke use requires careful planning and execution to prevent interference with offensive operations. Techniques to minimize interference in the offense include the following:

- Ž Use covered and concealed movement techniques. Assume the enemy can see through the smoke and avoid taking unnecessary risks.
- Time smoke delivery with decision points.
- Use unobscured weapons to overwatch.
- Do not let your own smoke silhouette your own forces.
- Plan to engage through or around smoke.
- Ž Plan for enemy countermeasure. This includes intensifying your counterreconnaissance and air defense efforts, minimizing reliance on visual signals, and increasing planning for counterbattery fires.
- Plan for additional maneuver time under smoke.
- Verify enemy locations. Use increased reconnaissance to counter enemy use of smoke for concealment.
- Know what enemy forces are most susceptible to VEESS use.

- Specify when to turn smoke on and when to shut it off.
- Ž Plan in conjunction with lifting and shifting fires.

Defense

Smoke and obscurant use in the defense multiplies the commander's ability to disrupt enemy attacks, seize the initiative, and project combat power at the critical time and place to defeat the enemy. VEES smoke can be used in the defense of a battle position to screen the vehicle from enemy ATGM gunners. Upon sighting an enemy missile, the commander immediately places smoke between his vehicle and the enemy gunner by firing smoke grenades and issuing the command to the driver to activate smoke. The driver activates VEES and drives using the cover of smoke to an alternate cover and concealed position. Once in the concealed position, the TC issues main gun fire commands to destroy the attacker. Used correctly, smoke will overcome any initial advantage of the attacker. Techniques to minimize interference in the defense include the following:

- Verify enemy locations.
- Ž Plan and use all sensor and viewer capabilities.
- Plan for enemy countermeasures to your smoke.